

# Microphone Array Signal Processing and Active Noise Control for the In-Helmet Speech Communication, Phase I

Completed Technology Project (2008 - 2008)



## Project Introduction

Widely varying working conditions of a space shuttle and the special design of an astronaut's spacesuit form an extreme acoustic environment that imposes unique challenges for capturing and transmitting speech communications to and from a crewmember. NASA has a serious unmet need for innovative voice communication systems and technologies, which provide enhanced speech intelligibility and quality, comfort and ease of use, and adequate hearing protection. This project will build on knowledge and recent breakthroughs produced by painstaking research at Bell Labs and WeVoice, Inc., in acoustic and speech signal processing for hands-free communications. It brings together the state-of-the-art and patent-pending techniques in microphone arrays, speech enhancement, and active noise control, and proposes an integrated, more reliable solution for combating high-level noise and strong reverberation. This proof-of-feasibility research will focus primarily on whether the proposed techniques that were previously developed for applications in room acoustic environments can perform as well as or better than we expect in an in-helmet acoustic environment. In addition, this research will use informal listening tests to demonstrate performance improvement and will design a subjective program that can be readily executed in Phase II to rigorously evaluate the overall system performance. The Phase I effort will provide a foundation for prototype design to be conducted in Phase II.

## Anticipated Benefits

Potential NASA Commercial Applications: The research will lead to the commercialization of two possible products/services: 1) voice communication devices working in adverse acoustic environments (e.g., those for pilots in a cockpit of an airplane, for soldiers in a combating vehicle, and for athletics in a race car.); and 2) more noise and reverberation resistant voice communication services for hearing-impaired and elderly people.



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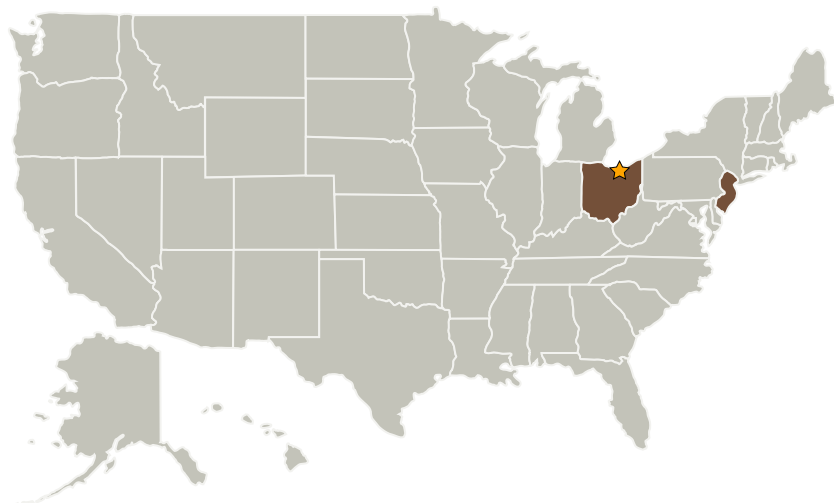
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
WEVOICE, Inc.	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Bridgewater, New Jersey

Primary U.S. Work Locations	
New Jersey	Ohio

## Project Transitions

**February 2008:** Project Start

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Glenn Research Center (GRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

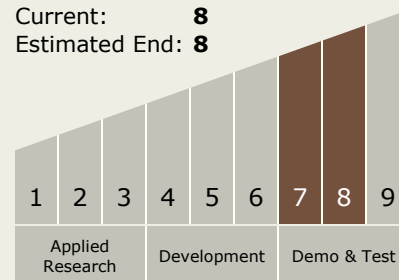
Carlos Torrez

### Principal Investigators:

Yiteng (arden) Huang  
Yiteng Huang

## Technology Maturity (TRL)

Start: **7**  
Current: **8**  
Estimated End: **8**



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**August 2008:** Closed out

**Closeout Summary:** Microphone Array Signal Processing and Active Noise Control for the In-Helmet Speech Communication, Phase I Project Image

## Technology Areas

### Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.2 Extravehicular Activity Systems
    - └ TX06.2.3 Informatics and Decision Support Systems